ON

THE MATERIALS USED

IN

PAINTING,

WITH A FEW REMARKS ON VARNISHING AND CLEANING PICTURES.

BY

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ON

THE MATERIALS USED
IN
PAINTING.

INTRODUCTION.

1. To the instructed observer, every picture displays the extent of the artist's knowledge of his art, and is also an evidence of his proficiency or ignorance of any portion of it.

2. The Artist's accuracy of drawing may be unimpeachable, yet his knowledge of perspective or of chiaroscuro imperfect. He may possess a knowledge of the harmony and contrast of colours, but be ignorant of the nature and properties of the pigments he employs to produce this harmony. Thus, his proficiency in one part of his art may be neutralized by his ignorance of another—his knowledge of harmony and contrast may be defeated by injudicious mixtures of his pigments; or by misdirected experiments with vehicles, which, giving rise to chemical changes in his paints, will tend to ensure the ultimate destruction of his pictures, as the works of Reynolds, Hilton, and Turner, sufficiently testify.

3. The question is often asked,—how it happens that so many pictures painted two, three, or even more centuries ago, look fresher and purer than others painted within the last twenty or thirty years.

4. This is a matter of the first importance to the artist. For every picture that is worth painting, must also be worth preserving; therefore the artist should spare no effort to secure his work from the ravages both of time and accident, as well as from the spontaneous changes that arise from the use of improper vehicles, or untried pigments.

5. Doubtless, every artist does his best to secure a good result; and if he fails, it is probably owing to the want of that information concerning the MATERIALS USED IN PAINTING, which it is the design of this little book to furnish, viz.: a knowledge of the materials of which a picture is composed, and of those by which it is protected against time, accident, and the noxious agents ever present in the atmosphere. These materials are PIGMENTS and their VEHICLES, or PAINTS and VARNISHES.

6. The first question we have to consider is,

WHAT IS A PAINT?

A PAINT is a substance,—usually a coloured earth, or artificial chemical product, called pigment—ground in some suitable medium, such as oil, water, &c., by which it can be spread on the surface to be painted.

7. PIGMENTS are obtained from the three kingdoms of nature; but by far the greater portion are derived from the *mineral* kingdom, such are the Ochres, Vermilion, Ultramarine, &c.; the *vegetable* kingdom supplies us with Indigo, Madder,

Gamboge, &c.; the *animal* kingdom supplies us with Carmine, Indian Yellow, Sepia, &c.

8. The artificial or chemical preparations are very numerous: they include Prussian Blue, Naples Yellow, Chrome Green, Zinc White, Cobalt, French Blue, the *Mars* series, the Lakes, and many others.

9. The natural or crude pigments are prepared for the artist's use by calcining, washing, grinding, &c.; and, for oil painting, are ground up in refined poppy or linseed oils; when applied to the canvas, the artist employs certain vehicles or mediums, such as magilp, prepared copal, &c., to give the requisite consistency to the paint.

10. From what has been said, it will be seen that PAINT is a very simple substance, consisting of the pigment and its vehicle. The qualities desiderated in the latter are transparency, freedom from colour, and the property of *drying*.

11. LINSEED OIL, rendered drying, becomes converted into a hard, tough, resinous substance, which suffers little change by atmospheric agents; these qualities eminently fit it for a vehicle in oil-painting.

12. If the pigment and the vehicle are both of good quality, and nothing is added to them that will destroy their integrity, they are almost imperishable; but when the artist, not content to "let well alone," desires to improve what is already good enough, and adds various nostrums to his paint, he thereby increases the dangers to which such works are already but too much exposed, without any compensating advantage.

13. PAINT, composed only of oil and pigment, is, when hard, insoluble in water and pure alcohol (spirits of wine,) but is slowly acted upon by oil, and more rapidly by spirits of

turpentine. This fact will be found of importance when we come to consider the subject of picture cleaning.

NOMENCLATURE OF COLOURS.

14. What follows will be better understood if we define certain terms employed when speaking of colours.

15. The *colour* of an object is that peculiar optical quality all bodies possess of reflecting certain coloured rays, and absorbing others. An object that *reflects* all the coloured rays possesses no colour, but appears white; while a body that *absorbs* all the coloured rays, appears black.

16. Ordinary-day light is termed *white* light. A ray of this light, a sunbeam, when decomposed by a prism, or as we see it in the rainbow, is found to consist of rays of six different colours. Three of these, Blue, Red, and Yellow, are termed *primary* colours, because they are the source from which all other colours are derived. Mixed in pairs, as Blue with Red, Blue with Yellow, Yellow with Red,—Violet, Green, and Orange are produced,—these are termed *secondaries.*

17. The PRIMARIES and the SECONDARIES are *pure* colours. When a mixture consists of all three primaries *grey* is produced, which goes to *break* or tarnish the purity of the pure colours, producing *broken* colours.

The term *tertiary colour* is too vague to be employed: what are commonly called tertiary colours are coloured GREYS or BROWNS.

18. For the pure colours there is a constant type in the colours of the prismatic spectrum, which we always have in view when speaking of colour in the abstract.

19. There are no constant types or standard for the so

called tertiary colours. No two persons will exactly agree as to the proper hue of an olive, russet, or citrine.

20. Pure white and black mixed, produce *normal grey*, which varies in tone according to the preponderance of either the black or the white. A primary or a secondary added to normal grey produces a coloured grey, thus we have blue, red, and yellow greys; orange, green, and violet greys.

21. A *normal colour* is that colour taken at its greatest intensity, without the addition of any other colour, or of white which weakens it, or black which deepens it.

22. A *tone* of a colour signifies the normal colour mixed with white or black in varying quantities, producing various light and deep tones; this term is equivalent to *lights* and *shades*.

23. A *hue* of a colour signifies a given colour mixed with small portions of another colour, but not sufficient to change its identity. Thus red may be mixed with various portions of blue, but not in sufficient quantity to make it purple; or with yellow in various portions, but not sufficient to make it orange; then all these mixtures produce various hues of blue. We can, however, take purple or green, and add blue or red to the one, and blue or yellow to the other, and so produce various hues of purple and of green.

24. It is only in the prismatic spectrum that Colour can be seen apart from any material substance, and consequently in a state of absolute purity. In attempting to represent these colours by material pigments we shall find that carmine very nearly approaches the prismatic red, as ultramarine and gamboge do blue and yellow. Natural pigments supply better compound colours than can usually be obtained by mixing pigments of

simple colours, for this reason, that scarcely any pigment reflects only one kind of rays. Thus ultramarine reflects, besides blue rays, a small quantity of red rays, which gives it a violet tinge; if we mixed a yellow with this blue, the compound would contain, besides green, a small portion of *grey*, produced by the presence of the red, combining with equal portions of the blue and yellow; the presence of this grey would impair the brilliancy of the green, or *break* it, as much so as if we added to a pure green a minute portion of grey or black pigment. In like manner, CARMINE, our purest red, contains a minute portion of blue, as also does gamboge.

If the artist, in mixing pigments, observes the tendency of a pigment to acquire another hue, and mixes with it only that colour with which it is tinged, he will obtain a tolerably pure compound. Thus in mixing blue and yellow for green, it will be better to take a blue tinged with yellow, and a yellow tinged with blue, than those pigments that contain red; since pure green consists only of blue and yellow, and the presence of red must break or tarnish its purity by introducing grey.

I shall not repeat the nonsense usually found in books about advancing and retiring, or *hot* and *cold* colours, nor endeavour to represent by arbitrary figures the relative powers of colours, by asserting that yellow is 3, red 5, or blue 8; such statements are entirely devoid of meaning, and are uttered in complete ignorance of the law of simultaneous contrast of colours, as developed by M. E. Chevreul.* Vague and fantastic assertion must give way before rational experiment and scientific proof.

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* *The principles of Harmony and Contrast of Colours, and their applications to the Arts,* translated from the French of M. E. Chevreul, by Charles Martel. 2nd Edition. Longman and Co., London. 1855.

25. In refutation of the statements alluded to, it is only necessary to remark that whenever two colours are placed in proximity, they no longer appear of the same hue as when viewed separately, but they mutually modify each other, not only in *colour*, but in *tone.* By juxtaposition, a *blue* may be made to appear greenish or violet; a *yellow*, orange or greenish; and a *red*, scarlet or crimson; a light colour may be made to appear lighter or deeper, and so with a dark colour; and as we seldom have to deal with isolated colours, it is evident that all that can be said of the *power* of a colour is relative, being entirely dependent upon the colour or colours with which it is associated.

THE PIGMENTS.

26. With two or three exceptions, the pigments derived from the mineral kingdom, such as ultramarine, the ochres, and bitumens, are the most durable; this is especially the case with those containing iron and copper. But the pigments derived from the vegetable and animal kingdoms, such as madder and carmine, leave little to be desired on the score of permanency, while the purity and brilliancy of their colours render them an important acquisition to the palette; as it would be impossible to supply their place from the resources of the mineral kingdom.

27. Pigments are opaque or transparent. The opaque are employed for representing light, for which their solidity and opacity eminently fit them; as the more these qualities are present in a pigment, the more light it reflects. For shadows and glazing, the transparent pigments are employed.

28. The permanence or durability of pigments is in some measure conditional; but as the consideration of this question involves much chemical knowledge, we can in this place only briefly indicate some of the more striking results of the action of light, air, and mixture upon pigments.

The action of light upon coloured bodies has, at present, been only imperfectly examined. Generally it is supposed to have a bleaching property. It is well known, however, that pictures kept for a long time in a dark room, or when turned to the wall, lose much of their brilliancy, and recover it again when exposed to sunshine or daylight.

Pure air cannot be considered to have an injurious effect upon paint, although the moisture always present in it may. But in cities and towns the atmosphere is contaminated with the sulphurous emanations from sewers, and from the combustion of coal and coal-gas. This sulphuretted gas attacks white, or carbonate of lead, and converts it into the sulphide, which is black.

Bouvier, in his *Manual for Painters and Amateurs*, says, "It is much to be wished that painters had more knowledge of the chemistry of colours than they usually possess." But this knowledge cannot well be acquired without studying the elements of general chemistry. When the artist understands what is meant by chemical decomposition, he will recognise how important it is that he should fully understand the chemical constituents of his pigments when he is about to mix them together. A very large proportion of the pigments prepared for artists' use are chemical compounds in which the respective constituents are united in fixed and definite proportions, which determine the colour of the pigment. The force that holds these respective constituents together is frequently so slight that the balance is easily disturbed by mixture, the pigment decomposed, and consequently changed in colour.

This knowledge will teach the artist that it is safer to mix such pigments together as are alike in chemical composition, and also to resort to *mixing* as seldom as possible, only when the desired effect cannot possibly be obtained without. The majority of pigments are sufficiently permanent for ordinary use; when employed alone, and even in mixture, the oil or varnish medium protects them greatly from chemical decomposition. In water-colour painting, change in composition from mixture of pigments is much more rapid and certain.

In the following descriptions of pigments, the chemical nature of the pigments is indicated so far as was compatible with the scope of this little book.

DAHLIA CARMINE is a fine pigment prepared from cochineal, more permanent than carmine; it is used in water colours, affording brilliant purple transparent tones of great value in flower painting.

PERMANENT CRIMSON LAKE. A fine transparent red pigment prepared from cochineal, tolerably permanent, and very useful in oil painting.

VIOLET CARMINE. A very beautiful pigment, transparent and permanent, useful in oil and water colours.

BLUE.

28. BLUE is one of the three primary colours. Mixed with yellow in various proportions, it yields various hues of green; in like manner, mixed with red, it furnishes various hues of violet, purple, &c.

29. Amongst our pigments, the nearest that approaches the blue of the prismatic spectrum, is ultramarine, and some choice samples of blue carbonate of copper. There is a slight tinge of red in both these pigments, but it is only evident by comparison with pure blue.

30. The complementary colour of blue is orange, the secondary composed of the other two primaries, red and yellow.

31. The principal blue pigments are ultramarine, native and artificial, cobalt, smalt, Prussian blue, and indigo.

32. ULTRAMARINE. This pigment has long stood at the head of those with which the artist's palette is supplied; to this pre-eminence its beauty and durability fully entitle it. It may be employed in all kinds of painting, and be mixed with all other pigments without decomposing them. By artificial light, ultramarine appears grey.

33. Ultramarine is obtained from the mineral *lazulite* or *lapis lazuli*, found in the granitic regions of Persia, China, and other parts of the world, but in very small quantities. It is probably a volcanic product, as it resists the action of fire.

34. The scarcity, and consequent high price, of native ULTRAMARINE has excited the ingenuity of chemists to produce artificially a pigment that should be fully equal to supply its place. Thirty years ago, only the native pigment was known; but since that date we have been supplied with the artificial product. The price of the former was eight guineas an ounce, that of the latter varies, according to its quality, from one shilling to twenty-five shillings the pound.

35. Analysis of native ULTRAMARINE shows that it consists of a combination of silicate of alumina, of silicate of soda, and

of sulphuret of sodium, in variable proportions; the colour is due to the presence of a minute quantity of iron.

36. Formerly, most of the artificial Ultramarine came from France, but Germany now supplies us with an excellent pigment.

37. Artificial Ultramarine comes to us under the form of a brilliant blue powder. There are a great many qualities; the inferior are used in dyeing and paper staining, they have a violet hue. The finer qualities are reserved for artists' use. Every exhibition contains pictures utterly ruined by the presence of this blue used in a crude state for skies.

38. This pigment is permanent in the air, and under the sun's rays; it is insoluble in water, alcohol, ether, the fixed, and volatile oils. It is quickly decomposed by acids. Submitted to a strong heat, it fuses into a colourless or very slightly coloured glass; if this calcination takes place in the open air, it acquires a green hue.

39. The process of manufacturing artificial Ultramarine is one of the most interesting in the arts; but the details belong properly to a treatise on Applied Chemistry.

40. Ultramarine Ashes. In the preparation of native ultramarine, a blue grey pigment is separated, to which the name of Ultramarine Ashes is given. It is useful to the landscape painter in supplying him with a delicate permanent pigment for skies, and for shadows in flesh tints.

41. Prussian Blue. A very intense blue pigment, slightly tinged with green. It is a compound of prussic acid and iron. Previous to its discovery in 1720, indigo was the only blue pigment used in the arts.

Prussian blue varies much in quality, according to its mode of preparation. That manufactured at Berlin contains alumina; but English and French Prussian blue generally contain alumina only as an adulteration.

When of good quality, this pigment is transparent and tolerably permanent. It is insipid to the taste, inodorous, insoluble in water, alcohol, oil, and diluted acids, (except muriatic and oxalic,) but is decomposed by several metals, such as tin and iron, by concentrated acids, alkalis, bin-oxide of mercury, and most of the metallic oxides. Heated strongly in the open air it burns like tinder, leaving a reddish brown residue; if kept from contact of air, it yields a fine black pigment.

A solution of Prussian blue in oxalic acid forms the well known *blue writing fluid.*

Prussian blue is more valued in water-colours than in oil-painting. It is useful to strengthen the tones of other blues, but its employment always requires consideration. It must not be mixed with vermilion, nor with cadmium, or mars yellow, if permanency is sought. It dries quickly, and if employed alone, no objection can be made to its use.

42. ANTWERP BLUE. This pigment only differs from Prussian blue in containing alumina, and sometimes carbonate of magnesia and carbonate of zinc. Its tone varies accordingly. It is considered to be as permanent as Prussian blue, and to have more solidity.

43. VERDITER. Is a carbonate of copper and lime, obtained by a peculiar mode of preparation. It is a sky-blue pigment, opaque, but not permanent, and is apt to turn green in oils.

44. COBALT BLUE. Of late years this pigment has been prepared in a state of great purity and beauty; it would in

many cases supersede French blue, had it not the objection of appearing violet by artificial light. It is transparent, durable, and mixes very well with other pigments in oil-painting. Its tone depends upon the quantity of alumina present in its composition.

45. SMALT. This pigment owes its colour to the presence of cobalt; it is a kind of frit or coloured glass, consisting of silicate of potash, oxide of iron, nickel, lime, magnesia, alumina, &c. Its tone depends on the relative proportions of silicate of potash and cobalt in the compound. It is of an intense brilliant colour, transparent and permanent; its hue is violet. Useful for draperies and in flower-painting in water colours.

46. INDIGO. Indigo belongs to the class of pigments called *lakes*, by which term is understood, such vegetable colouring principles as, being deficient in body, require the addition of an alkaline, or earthy base, such as lime, alumina, &c., to supply that body. Indigo has a lime base; it is of a deep blue colour, tinged with red, which gives it a violet hue. It is without taste or odour, and adheres to the tongue like pipe-clay. Ordinary solvents have but little action upon it; it is insoluble in water, cold alcohol, ether, the fixed and volatile oils, diluted acids, and alkalis. Concentrated boiling alcohol dissolves a small quantity. Exposed to the action of heat in the open air it melts at 554° and is partially decomposed, rising in purple vapours. In fuming sulphuric acid it dissolves almost entirely, forming Saxon blue, blue carmine, and other pigments.

Indigo is more useful in water colours than in oil; in the latter it is apt to become green or black; but in water colours it is a most valuable pigment—transparent, permanent, and mixes well with other pigments.

47. Intense Blue. This is a preparation of Indigo, but of a brighter tone. It must be carefully applied to the paper, since it attacks it so strongly, as to penetrate it completely.

YELLOW.

48. Yellow is a primary colour. Mixed with blue in different proportions it yields various hues of Green; with red it produces various hues of orange. It is the most luminous of colours.

The complementary colour of yellow is the secondary *violet*, which is composed of the other two primaries, blue and red.

Among pigments, gamboge more nearly represents the yellow of the prismatic spectrum than any other pigment. It has, however, a slight, but scarcely perceptible tinge of blue.

49. The yellow pigments are numerous, but a desideratum still exists in a transparent yellow adapted to oil painting; a pigment equivalent to gamboge in water colours.

Among the most important yellow pigments are cadmium yellow, chrome yellows, the ochres, gamboge, Naples yellow.

50. Cadmium Yellow. This is a comparatively recent addition to the palette. It is a remarkably brilliant colour, but has no transparency. It is composed of sulphur and cadmium, and therefore cannot be employed with pigments that have a lead base, such as white lead ; but with oxide of zinc, or zinc-white, it forms durable compounds. With blue pigments it forms rich greens. Much of the Naples yellow now sold consists of cadmium yellow and white lead, but this cannot be considered any improvement, as the objection to Naples yellow is its containing a portion of lead, which blackens when exposed to air containing sulphuretted hydrogen.

51. GAMBOGE. Gamboge is a gum-resin, consisting of from 75 to 80 per cent. of resin, and 20 to 25 per cent. of gum. Its characteristics are as follows: ether dissolves about four-fifths, leaving the gum as residue. Alcohol dissolves a large portion. It is insoluble in water, with which it forms an emulsion. Its colouring properties are very great; it will impart its colour to 10,000 times its weight of alcohol or water. Camphene dissolves the resinous portion of gamboge, leaving the gum untouched.

Gamboge is much employed in water-colours, being a transparent pigment, of a fine bright yellow colour, permanent, and mixes well with other pigments. In oil it is deficient in *body*, owing to the presence of the gum, but there is no doubt it can be made available, and that desideratum, a transparent yellow for oil-painting, obtained.

52. YELLOW CARMINE, OR GALLSTONE. Gallstone is obtained in such small quantities for the purposes of commerce that it is necessary to substitute some other substance as a pigment. Yellow carmine, obtained from Persian berries, precipitated by alumina, yields a transparent fugitive pigment equal in every respect to gallstone.

53. INDIAN YELLOW. The origin of this pigment has been much disputed. According to ERDMAN, who appears to be the best authority, it is the urinary deposit of the camel which has been fed on the fruit of the *mangostana onagifer*, the colouring principle of which is communicated to the urine, and afterwards deposited by it. This deposit is collected dried, and forms an article of commerce.

Cold water dissolves a very small quantity of Indian yellow; alcohol and ether have no action upon it; by analysis it is shown to consist of a combination of magnesia, with a peculiar organic acid to which the name of *purreic* acid is given; small quantities of carbonates of potash and lime, and of chloride of potassium, are also found in it. Its high price tempts fraudulent dealers to adulterate it with other yellow pigments, as chrome yellow, &c. But as pure Indian yellow burns like tinder, leaving scarcely any residue, the adulteration may be easily detected.

Indian yellow is of a very rich golden yellow colour, of good body, semi-transparent, and permanent. It dries slowly in oil.

54. NAPLES YELLOW. This pigment has enjoyed a high degree of popularity, more so, we think, than it is entitled to. Its composition was for a long time unknown, but analysis shows that it is the result of a combination of antimonic acid, with oxide of lead in various proportions. The original Naples yellow was probably a volcanic product.

Naples yellow is an opaque pigment, of a very fine yellow colour; it is easily decomposed by iron, therefore the palette-knife with which it is mixed must be of ivory or of horn, and it should be ground on a porphyry slab; on stone it acquires a disagreeable greenish hue.

Much of the Naples yellow now sold is cadmium yellow, mixed with white lead; zinc white would be preferable.

55. CHROME YELLOW. The metal chromium is a very important colouring material. As chromic acid it unites with several bases, forming chromates. CHROME yellow is a chromate of lead; there are many hues of chrome yellow dependant upon the proportions of acid and base, and the addition of the chromates of lime and barytes, and of sulphate of lead. The inferior qualities contain alumina, which it is supposed renders them more permanent.

Chrome Yellow is an opaque pigment, useful both in oil and in water colours, better employed alone, or with White, than with other pigments such as Prussian Blue, or Vermilion.

No less than six different Chrome Yellows are met with in commerce, varying in hue from pale primrose to Orange Vermilion.

56. Chromic acid mixed with strontian forms *Lemon Yellow;* and with zinc, various yellow pigments not yet named.

57. ORPIMENT. Sulphur and acid unite in various proportions, forming sulphuret of arsenic. Two native pigments are found, one of which is *realgar*, or bisulphuret of arsenic, and the other *orpiment*, which is tri-sulphuret; the first is of an orange-red colour, the other is golden yellow. The quantity found in nature is too small to supply the wants of the arts, therefore, these pigments are prepared artificially on a large scale as King's Yellow.

Native Orpiment is a pigment of metallic lustre, inodorous, insoluble in water, alcohol, ether, and the oils. It is unaffected by most of the acids, but nitric acid decomposes it. It is fusible and volatile without decomposition in closed vessels. It is not a durable pigment, and cannot be recommended for use, and it is very poisonous.

58. PATENT YELLOW or Mineral Yellow is a chloride of lead, obtained by decomposing litharge by common salt, (chloride of sodium) and exposing the resulting chloride to a great heat. There are various other processes of manufacture, but the result is the same, namely, a compound of protochloride of lead mixed with variable proportions of oxide of lead.

Patent Yellow is a brilliant light yellow pigment, opaque, and durable, when employed alone; exposed to sulphurous exhalations, it blackens slightly, but much less so than most other pigments with a lead base.

59. Chromate of Zinc. Many experiments have been made to substitue the oxide of zinc for the oxide of lead in all the chemical preparations of that metal employed as pigments. Chromate of zinc, prepared under certain conditions, advantageously replaces chromate of lead (chrome yellow.) As its name indicates, chromate of zinc is a compound of chromic acid and oxide of zinc. It is a very beautiful yellow pigment, opaque, permanent, and mixes well with other pigments.

THE OCHRES.

60. The Ochres form a class of pigments valuable for their permanency and general utility in painting. Their composition is very variable, but they may be considered as true chemical combinations of clay and oxide of iron, resembling *lakes.* The combination of these two oxides is só complete, that diluted acids have no effect upon them; it is only by heat and concentrated acids that they are decomposed. These qualities show that they are eminently fitted for pigments.

The native Ochres are yellow and red. The yellow is most abundant. By calcination, the yellow ochres become red, (Light Red.) Native red ochre is known as red chalk. Cologne Earth is a brown ochre; Indian Red and Venetian Red are native ochres.

61. Oxford Ochre is a very useful pigment in landscape-painting, both in oil and water-colours, affording fine green mixtures of good body, and permanent.

The *Mars* pigments are artificial ochres.

62. Mars Yellow. The pigments to which the word *mars* (iron) is prefixed, are artificial ochres, prepared with a view of obtaining colours possessing the good qualities of native ochres, but without the earthy tint that is sometimes objectionable to their use.

The *mars* pigments are prepared by precipitating certain soluble salts of iron by means of the alkalies, or alkaline earths, such as potash, soda, lime, and alumina. Their preparation is an exceedingly difficult and delicate operation which only long practice can overcome.

63. Mars Yellow is a pigment of a very fine colour, semi-transparent, and quite permanent, useful both in oil and water-colours.

64. By calcining Mars Yellow we obtain, (according to the degree of heat applied, and by other means kept secret by manufacturers,) *orange*, *brown*, *red*, and *violet* mars. Pigments of great durability, but expensive.

RED.

65. Red is a primary colour. Mixed with Blue in different proportions it yields Violet, Purple, Lilac, and their hues; mixed with yellow it produces Orange.

66. The complementary of Red is the secondary Green, composed of the two other primaries, Blue and Yellow.

67. The red pigments are of animal, vegetable, and mineral origin. Carmine is of animal origin, being obtained from the cochineal insect. It supplies us with the red that approaches nearest to that of the prismatic spectrum. From the vegetable kingdom we obtain the valuable series of Madder pigments, and the mineral kingdom supplies us with Vermilion, the red ochres, and other useful pigments.

68. Carmine. Among red pigments Carmine holds the first place, as in its *normal* strength it approaches as nearly to the prismatic red as Ultramarine does to prismatic blue. The light tones of Carmine are bluer than the normal colour.

The mode of preparing Carmine was kept secret for many years, it is now well known to be obtained from the cochineal insect, by an extremely delicate process which is only successful in very experienced hands.

The dried body of the cochineal insect yields to water and alcohol a beautiful red colouring matter, to which Mr. De la Rue has given the name of *carminic acid*. This colouring matter may be precipitated by alumina and oxide of tin, forming the pigment known as *Carmine*.

Carmine is certainly the most beautiful red pigment we possess. In commerce we meet a greater variety of qualities of it than of any other pigment. It is opaque, but very permanent, but mixes well with other pigments.

69. Madder supplies the artist with several valuable pigments, as Madder Lake, Rose Madder, Madder Brown, Purple Madder, Madder Carmine. They are distinguished for the purity of their hues, their transparency, and durability, in mixing well with other pigments, and in being equally useful in oil and water colours.

70. The Madder pigments are *lakes*. The colouring matter, *alizarine*, is separated by chemical process from the roots of the *rubia tinctorum*, and precipitated on an alumina base. Various qualities appear in commerce, the differences in which are due to the quality of the madder-root, the place of its growth, and the mode of its preparation.

71. By the action of sulphuric acid upon madder roots,

even those from which all the colouring matter appears to be extracted, or *spent madder*, a colouring material, *garancin*, is obtained, which possesses a greater tinctorial power than that first extracted; this is *Madder Carmine.*

72. MADDER CARMINE from the beauty of its colour and durability may be advantageously substituted for cochineal carmine.

73. VERMILION. This pigment is a compound of sulphur and mercury, called red sulphuret of mercury. It is found native in various parts of the world, particularly in the mines of Spain and Peru. It is also prepared artificially in France, Germany, Holland, China, and England.

Vermilion is a dense heavy substance of a blood-red colour, without taste or smell, insoluble in water, alcohol, ether and the oils. It is readily decomposed by heat, and when adulterated is liable to blacken in the atmosphere unless protected by varnish. With certain pigments, such as White Lead, Prussian Blue, &c., it cannot be mixed without risk of speedily changing. It is useful both in oil and water-colours.

74. SCARLET. This pigment, recently introduced into the arts, is a compound of iodine and mercury, (the *protiodide of mercury;*) as both its constituents are volatile, it may be supposed that the colour is very evanescent. Its durability depends upon the care with which it is prepared.

IODINE SCARLET is a bright coloured pigment, of good body, opaque, and very useful in flower painting. There is no other pigment that approaches it in brilliancy.

VIOLET AND PURPLE.

75. VIOLET is a secondary colour resulting from the mixture of blue and red rays in equal strength and proportion. In

purple the blue predominates over the red. Hyacinth and lilac are hues of violet.

76. Violet, a secondary, is complementary to the primary yellow. Those who entertain the idea of tertiary colours, say that Violet mixed with Green yields OLIVE (Blue Grey,) and that mixed with Orange it yields RUSSET (Red Grey.) Such is a fanciful theoretical result; in practice, the mixture of pigments of these colours produces only *mud.*

77. PURPLE. This colour can be readily obtained by mixture of suitable red and blue pigments, such as contain little or no yellow in their hues. The Purple pigments are Madder Purple, Burnt Carmine, Purple Lake, Mars Violet, Dahlia, and Violet Carmine.

78. MADDER PURPLE, as its name implies, is a pigment obtained from Madder of great strength and body, and rich colour. It is transparent, durable, and mixes well with other pigments. It is equally good in oil and water colours, and dries and glazes well.

79. BURNT CARMINE. This is carmine of cochineal torrefied until it assumes a deep rich purple colour; a pigment useful in water colour painting.

80. PURPLE LAKE. This pigment is obtained from cochineal, and in all its essential qualities resembles the other lakes. Its colour is violet rather than purple.

MADDERINE LAKE. Chromate of copper (Marron Rougeatre.) Chromate of silver is purple red; chromate of mercury is violet red.

Dahlia and Violet Carmines are both preparations from cochineal. They are tolerably permanent; are very brilliant colours, and useful in painting flowers or drapery.

GREEN.

81. Green is a secondary colour, composed of Blue and Yellow rays, its hue varying with the relative proportions of each, thus we have *yellow*-greens and *blue*-greens.

The complementary of Green is Red; the primary that does not enter into the composition of the secondary, green. Mixed with orange it produces (theoretically) the so-called tertiary, Olive (Yellow Grey.) Most of the Green colours met with in nature are Green-Greys, *i. e.*, contain a small proportion of red, which deepens their tone and alters their hue.

82. Green may be obtained by mixture of blue and yellow pigments; it varies in hue according to the respective qualities of the primaries. Prussian Blue and Indigo, with Gamboge and Burnt Sienna, are the most useful greens in water colours, to which may be added, on the yellow side, Yellow Lake, Italian Pink, Brown Pink, &c.

Most of the green pigments owe their colour to the presence of copper, in the state of carbonate.

83. Chrome Green. This pigment is a sesqui-oxide of chrome, which varies in hue according to the mode of its preparation. It is a fine, cool, deep green, very durable, and is much employed in enamel painting. Its high price limits its use. There is an *Emerald green* of great beauty and permanency, prepared from the oxide of chrome by a secret process. It is very costly. Chrome green is insoluble in water and the acids.

84. Emerald Green. The pigment usually sold under this name is not a chrome green as its name would seem to imply, but a copper green, consisting of carbonate of copper with lime or alumina. It is opaque and durable, but dries

slowly in oil; its colour is a very bright, vivid green. Another kind of Emerald Green consists of arsenic and copper, (the arseniate of copper.) It is a very brilliant blueish green, opaque and permanent. Its high price limits its use in the arts. By the French it is called *Paul Veronese Green*, but for what reason it is not easy to determine.

85. Terra Vert, called also Veronese Green is a native earth found near Verona, also in Hungary, France, and other countries; that obtained from Verona is the best. Its colour would lead us to suppose that it contains copper, but analysis fails to discover any. A sample examined for the purpose of detecting copper, showed that it consists of about fifty per cent of silica, in combination with alumina, magnesia, soda, and about twenty per cent. of protoxide of iron, to which, and not to copper, it doubtless owes its colour.

Terra Vert is a valuable pigment; especially useful in landscape and marine pieces. It is opaque and quite permanent. When burnt it it yields *Verona Brown*.

86. Verdigris is a basic acetate of copper. As met with in commerce, it varies in hue, from pure to blueish green. It is a bright green pigment, almost insoluble in water, transparent in oil, and permanent as a glazing pigment.

87. Sap Green is a *lake*, obtained from the colouring matter of the buckthorn united with a lime or alumina base. It is not adapted for oil painting, but is useful in water colours. Its colour is grass-green, but cannot be pronounced permanent.

88. Malachite Green. This beautiful green pigment when native, is a carbonate of copper, found in the mountains of Hungary and Siberia. It is opaque, of a delicate palish green colour, and tolerably permanent.

The scarcity of the native pigment has led to the production of several artificial pigments to supply its place in ordinary painting, either by imitating its chemical composition, or by mixing other ingredients. Some of these are carbonates, others are arseniates of copper.

ORANGE.

89. **Orange** is a secondary colour, resulting from the mixture of red and yellow rays. Its complementary is *Blue*, the primary which is absent from its composition. Mixed with Violet it (theoretically) produces Russet or Red Grey.

Orange ranks next to yellow as a luminous colour.

90. The principal Orange pigments are Red-Lead, Mars Orange, Orange Vermilion, Orange Chrome, and Red Orpiment. Some samples of Cadmium yellow possess a deep Orange hue.

91. **Orange Vermilion.** This is the lighter portion of crude Vermilion, which is separated when the latter is mixed with water; the orange portion being the lightest, occupies the upper portion of the pigment deposited by the water. It is permanent, and mixes well with most other pigments. Some specimens of Orange Vermilion are mixtures of Vermilion and Chrome Yellow.

92. **Red Lead, or Minium** is a mixture of the protoxide and binoxide of lead. It forms a pigment of a bright orange colour, much used in the arts, but has the objection of blackening in sulphurous vapours. It is opaque, but cannot be mixed with other pigments, except those that contain lead as a base.

BROWN.

93. **Brown** is a very indefinite term for a colour. Theoreti-

cally, browns are *Orange Greys*, that is, they are combinations of the three primary colours, with red and yellow, or orange, in excess. The various hues of brown must therefore depend upon the proportions of each of these two primaries present in a pigment.

94. Brown pigments are supplied by nature of a much better quality than can be obtained by mixture of the primary colours. Most of them owe their colour to the presence of iron in various states of oxidation, which in great measure ensures their permanency. Some, such as Bitumen and Vandyke Brown are of the nature of coal, changed by the action of heat, or by slow natural decomposition.

95. UMBER. Although this pigment derives its name from Ombria, one of the Roman provinces, from whence it was originally obtained, that now met with in commerce comes from the isle of Cyprus, and is known as Turkey Umber. It consists of about fifty per cent. of hydrated oxide of iron, and twenty per cent. of oxide of manganese mixed with flint and clay; it is employed in the natural state; when burnt it acquires a reddish brown hue.

This pigment is seldom employed alone. It mixes well with other colouring materials, is a good drier, and very permanent.

Boiled with raw linseed oil, in renders it siccative by the action of the oxide of manganese it contains.

96. TERRA DI SIENNA. This pigment is found in the environs of Sienna, a city in the grand duchy of Tuscany. In its natural state it is of a yellow colour, mixed with grey; when burnt it assumes a reddish orange colour; it is much esteemed in painting, both in oil and water colours, being transparent and permanent, and mixes well with other pig-

ments. In composition it is analogous to Umber, but contains less oxide of manganese.

97. VANDYCK BROWN, COLOGNE EARTH. This is a substance intermediate wood and coal, known as *lignite* or brown coal, found at Bruhl, near Cologne, on the Rhine. It is called ferruginous pulverulent lignite; in commerce it is known as Cologne or Cassel earth, and sometimes Cologne Umber, but it has no resemblance in its composition with Umber.

Cologne Earth is a very fine brown pigment, used both in oil and water colours, transparent and permanent.

98. CAPPAGH BROWN is a peat or bog-earth, coloured with manganese; it derives its name from the place, near Cork where it is found. It is a deep, transparent brown pigment, which dries well, and mixes well with other pigments without injury.

99. BISTRE is a brown pigment obtained from the root of certain woods, particularly that of the beech tree. It is much employed in water colours, for drawings like those of Indian ink and sepia. It is transparent and durable.

100. SEPIA. This pigment is obtained from a shell fish, common in the Mediterranean and Adriatic Seas, and the Atlantic Ocean. It is contained in a membrane near the heart of the fish, filled with a blackish brown fluid, from which by drying the pigment is prepared. In commerce, it appears when prepared, as a dark brown or nearly black impalpable *powder*, insoluble in water and in alcohol ; it dissolves partially in ether ; the caustic alkalies dissolve it without alteration ; diluted acids have no action upon it.

The colour of Sepia is a deep rich warm brown, affording a variety of agreeable tones. It is transparent and permanent, and of great value to the water colour painter.

101. Asphaltum or Bitumen is a natural product found floating on the surface of the Dead Sea, and in other countries. Its origin is undetermined, it appears to be a volcanic product, and is supposed to be produced by the melting of coal under strong pressure.

As it occurs in commerce, Bitumen resembles in its external qualities, pitch ; it is solid, brittle, transparent, black with a tinge of brown, and has a bituminous odour when rubbed or melted. It is very inflammable, and burns with much smoke. It is insoluble in water, soluble in turpentine, the fixed and essential oils. It is of a fine transparent brown colour, and quite permanent. It is very useful in oil painting for glazing, and if ground in drying oil stands well. It dries slowly. Asphaltum enters into the composition of certain varnishes, as japan, and Brunswick black.

There are a great many varieties of Bitumen, the properties of which vary from the description here given. There is also a factitious kind, a product obtained from the gas-works, but this is not fit for artist's use, as it never dries.

102. Madderine Brown. This pigment, of recent introduction, is a sub-chromate of copper, of very fine red marone or brown colour, opaque, and permanent; very useful in oil painting. Its hue differs according to the method by which it is prepared.

WHITE.

103. Theoretically, White is the union of all colours, but as pigments of colours as pure as those of the prismatic spectrum do not exist, the mixture of pigments of primary or secondary colours produces not white, but grey or black. A ray of white light when decomposed by the prismatic spectrum

is resolved into six distinct pure colours, and these may be reunited by a convex lens, and the ray of light re-produced.

104. The *opposite*, or complementary of white is black. White bodies reflect all or nearly all the rays of light that fall upon their surface.

105. Mixed with coloured pigments they yield the various light tones of the respective colours. With black pigments they form numerous tones of *grey*.

106. White pigments represent light, for which their density and opacity eminently fit them.

107. In associating coloured objects, the primary colours gain in brilliancy by the juxtaposition of white, but light blue and rose red form the most agreeable assortments with white; dark blue and red produce too strong a contrast to be agreeable.

108. WHITE-LEAD. This pigment is a carbonate of lead. It is known by more aliases than any other pigment used. It is Ceruse, Flake White, Cremnitz White, etc., these names are determined by the place or mode of its preparation. One enjoys great celebrity until another is produced, supposed to be superior, which for a time, supersedes it.

In chemical composition they are all identical, the difference in their hue arises from the method of preparation.

White-Lead is a dense opaque pigment, largely employed in oil-painting, for grounds and in mixing with coloured pigments to produce their various light tones. It is inodorous, insipid, insoluble in water, soluble in acids with effervescence arising from the liberation of carbonic acid gas. Exposed to heat, White-Lead becomes oxidised, first into *massicot*, which is yellow; if the heat is continued, more oxygen is absorbed, and the white-lead becomes *lithurge*, and finally *red-lead* or *minium*.

The chief, and perhaps only objection to White-Lead is, that the sulphuretted hydrogen almost always present in the atmosphere blackens it, as do certain pigments containing sulphur. This chemical change is retarded or entirely prevented when the paint is covered with varnish.

White-Lead possesses strong siccative properties; in this respect it is superior to zinc-white, but the deficiency of the latter in *drying* is overcome by the use of suitable dryers.

Whatever objections may lie against the use of White-Lead, it has obtained so strong a hold upon the preference of the artist, that it is scarcely probable it will be driven from the field by the rivalry of Zinc-White. Chemically speaking, it is inferior in durability to Zinc-White, yet White-Lead of good quality is found to stand as well as need be, if judiciously employed.

ZINC WHITE.

109. The introduction of oxide of zinc as a substitute for White-Lead is one of the most interesting events in the annals of art. As a pigment, it possesses all the qualities for which White-Lead is prized, without any of those which are objectionable. White-Lead cannot be mixed with many pigments without suffering decomposition. It is quickly acted upon by sulphuretted hydrogen, (evolved wherever human beings congregate, and frequently from gas-lights) which turns it grey or black. Besides, it is very poisonous. None of these objections lie against Zinc-White. From the great improvements recently made in the processes of its manufacture its density is greatly increased, while its covering power is greater, weight for weight, than that of White-Lead. Experiments show that one pound of

Zinc-White covers as much surface as sixteen and a half ounces of White-Lead.

Zinc-white is insoluble in water, ether, alcohol, and the oils, both volatile and fixed, but the acids of moderate strength decompose it. It is unalterable by heat. Hydrosulphuric acid and the alkaline sulphurets form with it a white sulphuret, which does not blacken. It is opaque, permanent, and mixes well with other pigments.

Efforts are being made to produce various coloured pigments in which zinc shall take the place of lead as a base.

It must be evident that the vehicle for Zinc-White should not be the ordinary drying oil prepared with litharge; as that dryer being an oxide of lead, would impart to the zinc-white the objectionable qualities possessed by White-Lead. A drying oil is prepared expressly as a medium for Zinc-White, which is equally adapted for other pigments.

BLACKS.

110. Black-pigments are Carbons or Charcoals of greater or lesser purity, derived from animal and vegetable substances. Pure Carbon is probably of a pure black, but the presence of earthy matters in the substance from which the pigment is obtained, imparts to it a grey or brown hue. These foreign matters are the salts of lime, magnesia, soda, &c.

111. Black is very useful in painting, both by itself and mixed with white to form Normal-grey, of various tones. Besides black-pigments, black is produced whenever pigments of the three primary colours are mixed together in suitable proportions, or when a secondary is mixed with its *opposite* or *complementary* primary.

112. Blue-black is a vegetable black, obtained by heating vine twigs, or the kernels of peaches, apricots, &c., in a closed vessel until they are converted into Charcoal. It is a very fine black and yields with white pigments fine pearly *greys*.

113. Ivory-black is an animal-black, obtained from the chips or turnings left by the ivory-turner. When it is really obtained from this source, it possesses a fine rich tint, and produces with white, good warm greys. It dries slowly. Sometimes bone-black is substituted for it.

114. Lamp Black is a soot obtained by burning, with slight access of air, certain resinous substances, oils, &c. It is a very dense, opaque, pure black. A very fine black is obtained from the soot of coal-gas.

115. Most of the Lamp-Blacks contain empyreumatic resins, which give them a brown hue, and prevent their mixing with water. To fit them for water colour painting the Lamp-Black has to be heated to redness in closed vessels, or the resins dissolved out by alcohol.

116. Indian Ink. Much ingenious speculation has been bestowed upon the source of this pigment, which brought from China, could not for a long time be imitated with success, but at the present day we need not be under any obligation to the Chinese for a pigment which can be made at home of as good quality as theirs.

GREY.

117. Normal-grey is produced by the mixture of pure Black and White, yielding various tones of pure grey, according as the White or Black predominates. It is also produced by the mixture of the three primary colours, or by a colour with its *opposite* or *complementary* colour, as in the case of

black. Normal-grey may be cosidered as diluted black. As most of our pigments contain two of the three primary colours, when mixed with each other a small quantity of grey is produced, which tarnishes or breaks the purity of the mixture.

118. Coloured Greys are Normal grey, coloured with a primary or secondary colour. They are produced when we mix the three primaries in unequal strength and proportions, so that one or two of them predominate. If we mix green and violet we obtain a *blue*-grey; if we mix orange and violet we obtain a *red*-grey; if orange and green a *yellow*-grey.

119. Mineral Grey is obtained from slate, which is finely levigated, for artists' use in oil-painting. There are two pigments of this same material, differing in hue, but not in quality. They are opaque, and quite permanent.

THE LAKES.

120. The differently coloured *lakes*, the nature of which we will endeavour to describe, are supposed to have been invented by the Dutch.

Most of the colouring principles obtained from the vegetable kingdom possess the property, when they are suspended or dissolved in water, of being precipitated by metallic oxides, with which they combine, and form insoluble compounds, known in the arts by the name of *lakes*. Thus we have Yellow, Crimson, and Purple lakes. The power of affinity which unites these colouring principles to the metallic oxides is very great; by some chemists they are supposed to form true chemical combinations. Whatever the nature of these compounds may be, it is enough for the artist to know that they furnish him with a very useful series of pigments, which at the present day he could scarcely do without.

121. The Lakes have always alumina for a base; sometimes, however, this consists of the oxides of lead and tin, of lime and magnesia. The base determines the colour of the pigment. Thus Yellow berries yield a deep yellow with alumina, and a yellowish brown with alkaline carbonates.

122. Alumina has a peculiar affinity for animal and vegetable colouring matters, and constitutes one of the best mordants of the dyer. For the artists' uses, the simple colouring matter of cochineal, madder, etc., would be unavailable unless they were combined with some material to give them *body*, and the substances that serve the dyer as mordants,—alumina, oxide of tin, and chalk, are well adapted for the purpose the artists' colourman has in view.

123. Indian Lake. This is supposed to be the parent of of all the *lake* pigments. From *lac*, familiarly known as shell-lac, a dye-stuff is obtained known in commerce as *lac-dye*, a colouring matter extensively employed in dyeing and calico printing. Indian Lake is this colouring matter precipitated from its solution by alum. It is inferior in brilliancy to Cochineal, but appears to be more durable. It is a purple red, transparent, and mixes well with other pigments. In its drying properties it resembles the other lakes, which, when badly prepared and kept long ground in oil, assume a gelatinous consistence, become *livery* as it is called, from the resemblance they present to the liver of animals.

124. Yellow Lake. This pigment is the colouring principle of Persian berries united to an earthy base. It is of a greenish yellow hue, useful in mixing greens for landscape

painting in water colours. It is not so durable as most other yellow pigments.

125. Mineral Lake. This is a valuable pigment used in porcelain painting, which is deserving the attention of the artist. It is a compound of oxide of chrome, lime, and binoxide of tin; its colour is that of the peach blossom, permanent, and is a valuable substitute for vegetable lakes in obtaining a good lilac colour.

THE PINKS.

126. Under this anomalous title is included a class of pigments which resemble the *lakes*, in deriving their colouring material from French or Persian berries, but they have as a base carbonate of lime (whiting) instead of alumina. They are considered less permanent than the Lakes.

127. Brown Pink is obtained from French or Yellow berries (*Rhumnus infectorius*) grown in large quantities at Avignon.

Italian Pink is the colouring matter of Persian berries, nearly identical with French berries of a brighter yellow colour.

VEHICLES AND MEDIUMS.

128. The vehicle or medium most extensively employed in oil painting is linseed oil; poppy oil and walnut oil are also used with pigments of delicate colours, which the deep hue of linseed oil might injure. Copal and Amber varnishes, and a mixture of drying oil and a mastic or copal varnish (*magilp*) are used as Vehicles.

OILS.

129. Oils are obtained from the animal and vegetable kingdoms; they are either *fixed* or *volatile.*

130. Fixed Oils. The fixed oils are either greasy or drying oils; of the greasy oils some are fluid at ordinary temperatures, others are solid, as tallow, butter, etc. They are insoluble in water, slightly soluble in alcohol, but dissolve largely in ether and in turpentine. They give a permanent greasy stain to paper, and cannot be distilled without decomposition. They absorb oxygen from the atmosphere with more or less rapidity; if slowly and in small quantity, the oil becomes rancid, but does not alter its appearance

Others, absorbing larger quantities of oxygen thicken; and if spread in a thin layer or coat become solid, and resemble resins; such oils are termed *drying oils*; linseed, poppy, and walnut oils are of this kind.

131. Linseed Oil. This oil is extracted from the seeds of the flax plant, (*linum usitatissimum.*) If obtained by simple pressure, without the aid of heat, it is called *cold-drawn* linseed oil. It is of a deep yellow or brownish colour, with a disagreeable smell and taste. It is soluble in ether and alcohol,* and turpentine, When spread in a thin coat it *dries* into a hard, tough, transparent varnish, a property which is increased by boiling the oil alone, and still more by the addition of certain metallic oxides.

132. The colour of linseed oil—considered as an objection to its uses in oil painting—may be removed by the agency of

* Linseed oil dissolves in five parts of boiling alcohol, in forty parts of cold alcohol, and in two parts of ether.

light. Exposed to the sun's rays for an indefinite length of time its colour becomes paler.

133. Besides its great use as a vehicle in oil painting, linseed oil is employed as a solvent of the hard resins, copal and amber, in the manufacture of varnishes.

134. Nut Oil. Large quantities of oil are obtained in France from ripe walnuts. By simple pressure, without the aid of heat, a sweet limpid oil is obtained, almost colourless, which dries slowly when exposed to the air. Treated with metallic oxides it becomes, like linseed oil, more siccative. It is employed for delicate pigments.

135. Poppy Oil. This oil is extracted from the seeds of the poppy. It is of a pale yellowish white colour, less viscid, but more drying than linseed or nut oils; it may be rendered more siccative by the same means as are employed with them.

136. Magilp. By this name is known a mixture of mastic varnish and drying linseed oil, which gelatinizes and forms a vehicle which prevents the pigments flowing on the canvas. Some doubts are expressed as to the policy of using it, but while most condemn its use almost everyone does use it.

137. Essential Oils. The *essential* or *volatile* oils differ in all their properties from the *fixed* oils, as much so as two things called by the same name can possibly differ.

They are generally secreted by plants; they do not saponify by the addition of alkalies; they can be distilled without decomposition; they give to paper a greasy stain, which, however, disappears as the oil evaporates. By exposure to the air they absorb oxygen, and become resinous. They mix in all proportions with fixed oils, dissolve freely in alcohol and ether, are insoluble in water. As solvents of the resins they are of great value.

138. *Turpentine* may be taken as a type of an essential oil; and it is the one most employed in painting.

139. When a volatile is added to a fixed oil, it dilutes it; and a coat of the mixture leaves, on drying, a thinner coat than when it is employed alone, in consequence of the evaporation of the essential oil.

140. *Oil of Spike* and *Oil of Rosemary*, essential oils, are used for dissolving copal and other resins.

DRYING.

141. It is necessary to explain what is meant by the term *drying* when applied to oil or oil-paint, as it is a misnomer.

142. Usually, by *drying* we understand that a body parts with its moisture, and becomes so much lighter in weight in proportion to the quantity of water evaporated.

143. But oil in drying, or becoming hard and solid, loses nothing in weight, on the contrary, it becomes heavier in consequence of absorbing oxygen.

144. This fact can be easily proved by covering a piece of glass with a coat of oil-paint, weighing it while wet, and afterwards when dry; it will be found to have increased in weight.

145. That the drying is due to the absorption of oxygen is proved by the oil becoming solid more rapidly in a vessel filled with oxygen gas, than in the atmosphere. In a vessel filled with carbonic acid gas the oil will not become solid at all.

146. Some substances retard the drying of oils; these are the black pigments, the lakes, bituminous earths, bitumens, &c.

DRYERS.

147. Dryers are the substances added to oils to increase their siccative property. The most important are the protoxide of lead, and the peroxide of manganese. Sulphate of zinc (*white vitriol,*) acetate of lead (*sugar of lead,*) sub-carbonate of zinc, are also substances employed as *dryers;* but the pigments themselves, such as white-lead and *zinc-white*, and heat, greatly increase the natural siccative property of drying oils.

The influence of these agents on the oil may be thus made evident.

148. *Influence of air.* Pure cold-drawn linseed oil spread upon glass takes about seventeen days to become hard or dry.

149. If, however, the oil is previously exposed to the air in an open vessel for forty or fifty days, it becomes more siccative, and will dry in about four days. It also loses its dark brown colour, becoming as pale as nut or poppy oil, and can be used with the most delicate pigments.

150. *Influence of heat.* Boiling or baking as it is sometimes called, causes linseed oil to become siccative, but the duration of this boiling has a remarkable effect upon the result.

151. If the oil is boiled for three hours without the addition of a *dryer*, it dries in about half the time it takes to dry when unboiled; but if the boiling be prolonged to five hours, the oil dries much slower than when boiled only three hours.

152. If the oil is first boiled, without addition, for five hours, then boiled again three hours, it takes longer to dry than if it had not been boiled at all, as much as forty days.

153. If the oil is first boiled five hours, then boiled again

eight hours, it loses its siccative property entirely; it becomes viscid, and remains so at the expiration of fifty days.

154. The common opinion is, that as boiling causes linseed oil to become siccative, the more it is boiled, the more that quality is increased; but such is not the case.

155. *Influence of Litharge.* If linseed oil is boiled three hours with about ten per cent. of protoxide of lead (*litharge*) it becomes very siccative, and dries in about two days; but if the oil is first boiled without addition, for five hours, then boiled with ten per cent. of litharge for three hours, it takes four days to dry.

156. *Influence of per-oxide of manganese.* A very siccative oil is obtained by boiling pure oil for five hours, and then boiling it eight hours with per-oxide of manganese.

157. When boiling the oil is objectionable, a good drying oil may be obtained by exposing the linseed oil mixed with ten per cent. of per-oxide of manganese to a temperature of 160° for eight hours.

158. A remarkable fact is, that the power of the litharge and manganese in causing oil to become siccative is greatly increased after they have been previously employed for the purpose.

159. No less singular is the following fact. The drying property of pure linseed oil is represented by 1.985; of manganese oil by 4.719. It would be supposed that if we added to pure linseed oil, one-fourth of its bulk of oil boiled with manganese, the drying properties would be represented by 6.704, whereas, in fact, it is 30.827, or more than four and a half times as much. This fact can be turned to account. Manganesed oil is of a very dark colour, and cannot be used

with many pigments, but we can take cold-drawn linseed oil, and, by boiling it with a fourth part of the manganised oil, obtain a highly siccative oil but very slightly coloured.

160. *Influence of sub-carbonate of zinc.* The addition of sub-carbonate of zinc to linseed oil is attended with a curious result; the mixture dries very quickly, but instead of being opaque, like the mixture of oxide of zinc with linseed oil, it is semi-transparent, and even transparent. Probably this fact may be turned to account in glazing.

161. *Influence of sugar of lead.* Sugar of lead (*acetate of lead,*) added to pure linseed oil, increases its siccative property. The advantage of adding it to oil already rendered drying is not very evident.

162. *Influence of Sulphate of Zinc. White vitriol* (or *white copperas* as it is sometimes called,) is a sulphate of zinc. It is used as a drier. When calcined, added to zinc-white ground in linseed oil, it accelerates the drying of the paint.

163. *Influence of Pigments.* Since the introduction of zinc-white as a substitute for white-lead has become general, it will be useful to enquire what difference exists between the siccative properties of these two metals.

164. A coat of paint prepared with pure linseed oil, mixed with white-lead in the proportions of 10 parts by weight of the first with 18 parts of the second, was spread on a canvas primed with white-lead ground in drying oil.

The 1st coat dried in 4 days.
,, 2nd ,, 3½ ,,
,, 3rd ,, 3 ,,

10½ days.

165. Another paint was prepared with 10 parts of pure linseed oil ground with 7 parts of zinc white (oxide of zinc.)

The 1st coat dried in 18 days.
,, 2nd ,, 15 ,,
,, 3rd ,, 5 ,,
38 days.

It is evident then that zinc white cannot be used without the addition of a dryer.

166. *Influence of Turpentine.* Turpentine added to pure linseed oil increases its siccative property.

167. Pure linseed oil and turpentine kept in corked bottles forty-four days, then mixed, when spread on glass dried in twenty-two hours.

168. The same materials exposed to the air forty-four days, dried in fifteen days, when spread on glass.

169. But if the oil and turpentine were first mixed, then kept forty-four days in a corked bottle, the mixture spread on glass dried in sixteen days. If the mixture was exposed forty-four days to the air, then spread on glass, it dried in nine days and a half.

170. *Influence of Zinc white.* If a mixture of oil and Zinc white dries in eleven days, the addition of Turpentine causes it to dry in six days. The mixture of oil and turpentine kept forty-four days, which dried in sixteen days, when zinc white was mixed with it, dried in seven days and a half.

171. Zinc white was added to the same mixture which had been exposed forty-four days to the air, and which dried in nine days and a half,—the paint dried in five days and a half.

172. Paint may be kept fresh any length of time if it is kept

under water, provided the pellicle that forms on its surface is not broken, and the water renewed as it evaporates. The water protects the paint from the action of oxygen.

173. *Influence of temperature.* Drying is greatly accelerated by heat. A picture will dry much quicker in a warm and dry atmosphere than in one that is cold and damp.

174. *Influence of the ground.* The surface upon which a drying-oil or paint is applied exercises a great influence upon the drying. If the ground is absorbent, a much thinner surface of oil and paint is left to be acted upon by the atmosphere, and the drying is more speedily accomplished.

175. Linseed oil spread on sheets of copper, brass, zinc, and iron dried in about two days; on lead it dried in six hours. On planed deal it dried in seventeen days, on poplar in twenty-three, and on oak in thirty-four days.

VARNISH.

176. A Varnish is a resin dissolved in a suitable medium, as oil, turpentine, or alcohol, forming a transparent fluid, which, when applied to the surface of a picture, serves to protect it against accident, and the destructive action of noxious agents present in the atmosphere.

177. The essential qualities of a good varnish are transparency, durability, and hardness; that it should be free from colour, and dry quickly. These qualities must necessarily depend upon the nature of the resin employed, and also, although in an inferior degree upon the solvent, which may be either volatile or fixed.

178. The *resins* commonly employed for picture varnishes are MASTIC, COPAL, AMBER, SANDARAC, and WHITE LAC.

179. The *solvents* are TURPENTINE, forming Turpentine Varnishes; ALCOHOL, forming Spirit Varnishes; LINSEED OIL, forming Oil Varnishes.

180. Under ordinary conditions *Mastic* resin is soluble in Turpentine and in Alcohol.

181. *Sandarac* is soluble in Alcohol, but insoluble in Turpentine.

182. *Copal* and *Amber* are soluble in boiling Linseed oil, but insoluble in Alcohol and Turpentine.

183. The properties and qualities of a varnish depending mainly on the Resin, an examination of that substance will enable us to judge its fitness for the purpose.

184. One of the chief qualities of a Varnish is hardness; it offers the security of great durability, and is less easy of removal from the surface to which it is applied.

185. We find that the softer and more brittle the resin, the more readily soluble it is, and the more liable to injury.

186. If we examine specimens of the resins employed in making picture-varnishes, we find that in respect to brittleness and softness they take rank as follows:—Sandarac, Mastic, Copal, and Amber.

187. Sandarac is therefore the weakest, most brittle, and readily soluble; while Copal and Amber are the toughest, hardest, and most difficult to dissolve.

188. The *solvent*, however, exercises some influence on the result of a varnish.

If the solvent is *volatile*, like turpentine and alcohol, when the varnish is spread and dries, the solvent evaporates, leaving the resin exactly in the state it was before it became varnish. Such varnishes dry as quickly as they are applied.

189. But if the solvent be a *fixed oil*, then all the varnish, both oil and resin, remains on the canvas, and in addition to the resin, there is the hardened oil, which, by absorbing oxygen, has also become a tough resinous substance.

190. It is evident then, that an oil-varnish possesses many advantages over a spirit or turpentine varnish, in being harder and tougher, and less easily removable from the surface of a picture by the action of solvents. When an oil-varnish is applied to the painted surface of a picture it softens the paint while drying, and ultimately combines with it. The spirit varnishes are used chiefly for ornaments, toys, etc.; the turpentine and oil varnishes for pictures, etc.

THE RESINS.

191. In the language of commerce the Resins are called indiscriminately, Gums and Gum-resins, but in the language of science each of these names belongs to substances possessed of very different properties.

192. Gum is a substance that softens or dissolves in water, but which will not dissolve in alcohol, or in the fixed and essential oils. The solution of Gum in water forms mucilage, and Gum Arabic is a type of this class of substances, or of Gums properly so called. A solution of Gum Arabic serves as a varnish in water-colour.

193. Resins are fusible and combustible substances, insoluble in water, but soluble, some in the fixed oils, some in the volatile oils, others in alcohol and in ether.

Mastic, Copal, Sandarac, and Amber are true resins.

194. GUM-RESINS are chiefly used in medicine; they partake of the qualities both of Gums and Resins, being partially or imperfectly soluble both in water and in alcohol, and the essential oils. Gamboge is a gum-resin.

195. Most of the resins appear to be compounds of two or more resins, as is shown by their partial solubility in one menstrum, and complete solubility in another.

196. SANDARAC. This resin is obtained from a Juniper tree, (the *Callitris quadrivalvis*,) and is the one usually employed for making spirit varnish. It appears to consist of a mixture of three kinds of resin, one soluble in ordinary alcohol; one insoluble in alcohol; and another soluble in alcohol of 90 per cent.

Sandarac is met with in commerce in the shape of tears of a yellowish-white hue, transparent, brittle, and inodorous; it is less soluble in turpentine than in alcohol, and not at all soluble in water.

The brittleness of this resin requires that some ingredient should be put into the varnish that will give it more tenacity. Turpentine, by containing a small quantity of resin, added to the spirit in which the Sandarac is dissolved, is found to produce the desired result.

197. MASTIC. This resin is produced by the *pistachia lentiscus*, a tree growing in the Grecian Archipelago, particularly the Isle of Chio. The best quality is in small oblong rounded tears, of a pale yellow colour, transparent, and brittle. It breaks with a bright glassy fracture; when chewed, it becomes soft and ductile, with a mild and agreeable taste an odour.

When heated, it melts; at a higher temperature it burns, diffusing an agreeable odour. Like other resins, it is insoluble in water, but dissolves completely in ether. It is partially soluble in cold, and completely soluble in hot alcohol. Dissolved in Turpentine, it forms the ordinary picture varnish.

198. *Mastic Varnish* is usually made as follows:—10lbs. of picked Mastic, 2 gallons of Turpentine, put into a tin can with 2 lbs. of glass, bruised to the size of barley; agitate the whole until the resin is dissolved; then strain it through fine muslin. It should be kept six or nine months before it is used.

199. DAMMAR. There are several resins known by this name. New Zealand Copal, or *Dammar Australis*, is distinguished from East India Dammar by its not dissolving in Essential Oils. There is a Dammar brought from the Isle of Amboyna, a product of the *Agathis laranthifolia.* The Dammar resin met with most commonly under that name is of a tender friable resin; it greatly resembles Mastic, and is becoming extensively substituted for it. This resin dissolves in Alcohol and in Turpentine, and forms a very clear and transparent varnish, which dries well, but is not free from murkiness. Mastic Varnish is much adulterated with this.

200. A good spirit-varnish is obtained by dissolving Dammar resin in Alcohol mixed with one-fourth its bulk of Turpentine.

201. COPAL. This name is common to several resins possessing different qualities, according to the tree which produces it. It is brought from the East Indies, Africa, New Zealand, and Brazil. The hardest, and what may be considered the true Copal, is brought from Calcutta. This is a

very tough and hard resin, which requires to be melted before it will readily mix with its solvent.

Copal is soluble in boiling linseed oil. Digested in boiling alcohol, it swells, and takes a soft and elastic consistence. It will dissolve in absolute alcohol if previously pulverized and dried at a gentle heat. Camphor added to alcohol, increases its solvent powers.

Copal, dissolved in linseed oil, forms a very valuable varnish; and when pale and of the best quality, is preferable to any other as a picture varnish. Being so difficult of solution, it cannot be removed from a picture without destroying it, and serves the more efficaciously to protect it against the wanton attacks of the "cleaner."

202. Copal Varnish is used as a Vehicle in oil painting.

203. Turpentine has very little action on copal until it is fused, when it becomes readily soluble in it.

204. It is sometimes desirable to obtain copal varnish without oil, the following is given as a formula for its preparation:—4 parts copal, 1 camphor, 12 ether, 4 absolute alcohol, ¼th camphine. As this mixture is very inflammable, and would be liable to explode if brought near flame, the ingredients should be placed in a warm room, and agitated from time to time until the copal is dissolved.

205. Amber. Amber is a fossil resin, washed up by the sea in different parts of the world, particularly in the Baltic. It is met with in irregular shaped brittle pieces, of that peculiar yellowish colour to which it gives its name, Amber Yellow. It is translucent, and devoid of taste and smell, partially soluble in ether, but is not acted upon by water or alcohol. It melts with difficulty; the usual solvent is boiling linseed oil.

Amber varnish is the hardest and most durable of any; the only objection that lies against it is its dark colour, which limits its use in pictures containing light hues of blue and red, with white. It was doubtless used as a vehicle by many of the old painters whose works have in consequence become almost indestructible.

206. Lac. The substance familiarly known as *Shell-lac* is a resin of animal origin, produced, like kermes and cochineal, by a *gall* insect *coccus lacca;* the females collect in great numbers around the small branches of trees to deposit their eggs, which they cover with a resinous substance; this is *lac,* known in commerce as *stick-lac.* Shell-lac is obtained by melting the stick-lac in boiling water, and pouring it out on flat stones, when it cools and hardens.

Shell-lac is of a bright orange or reddish brown colour, soluble in alcohol and in a solution of borax, but not in cold turpentine. It is a principal ingredient in sealing-wax, lacquers, and certain manufacturing varnishes. When bleached, it forms *white-lac* varnish, which from its transparency, hardness, and durability, is recommended for use in the arts.

207. A red colouring matter is obtained from Lac, known as *lac-dye,* from which, before cochineal became as well known as it is at present, the finest red pigments were obtained, the red lakes, *Indian lake* is now the only one in request.

208. The solution of lac in borax has been proposed as a vehicle, but there does not appear to be any necessity for it, or any advantage to be obtained from its use.

SOLVENTS.

209. By distilling crude Turpentine, derived from the

pinus palustris, of North America, we obtain the Essential oil, *Spirits of Turpentine*, a clear, colourless liquid, like water, of peculiar odour, and a solvent of most of the resins. The ordinary turpentine of commerce contains a small quantity of resin, as may be seen, by spreading a little on a piece of writing paper, it leaves an oily-looking stain, after the spirit has evaporated. In making varnishes of brittle resins, the presence of this turpentine-resin is not objectionable, although if present in too large quantities, it produces *tackiness*.

Turpentine is insoluble in water; it dissolves in 17 parts of alcohol, the solvent power of the mixture being stronger upon certain resins than turpentine would be alone.

Turpentine mixes in any quantity with the fixed oils, and oil-varnishes. It serves to dilute them, and enables us to apply and spread them more freely to a surface, while it accelerates their drying.

210. Spirits of Turpentine re-distilled, yields *Camphine*, a spirit of greater purity and solvent power. When spread on paper, it dries and leaves no stain. Camphine may be advantageously substituted for Turpentine in all delicate preparations.

211. ALCOHOL, or *Spirits of Wine*, as it is usually termed, is the product of the distillation of fermented liquors. It is a colourless, transparent, inflammable liquid, mixes with water in all proportions, dissolves the essential oils, and the fixed oils only slightly.

It dissolves certain resins, forming with them *spirit varnishes*. The solution of Mastic in alcohol is cloudy, shewing imperfect solubility of the resin. Water added to solutions of resin in alcohol, precipitates the resin.

Alcohol will not dissolve an oil varnish after it has become hard, nor a turpentine varnish if the resin of which it is composed is insoluble in alcohol.

212. Linseed Oil. This is the solvent usually employed for the hard resins, Copal and Amber. The great heat required to melt these substances precludes the employment of volatile oils, as before they could act upon the resins, they would be entirely dissipated by the heat. But if an oil-varnish is too thick, as it generally is, it can be diluted, or made thinner by the addition of an essential oil, as turpentine.

The resins appear to possess no siccative property; it is therefore necessary that the oil used as a solvent should be rendered *drying*.

In treating on Dryers and Drying-oils, we have shown the various methods by which pure linseed-oil may be rendered siccative.

WATER MEDIUMS.

213. The only medium used in water colour painting necessary to mention, is Gum Water.

Gum Arabic is soluble in cold water, with which it forms a viscid, adhesive, tasteless solution, to this a little white sugar so added to prevent the gum scaling off when dry, as it is apt to do if too thick.

214. Gum Water serves to fix the pigments on the paper in which they are applied; it gives transparency to the shadows, and serves as a varnish to resist abrasion.

Gum Tragacanth will not dissolve in cold water, but swells up, forming a gelatinous mass, that serves as a water magilp.

215. Ox-Gall is added to the water colour medium to remove any greasiness paper may acquire from handling, &c.

With delicate blue pigments it should be colourless, or its yellow colour may give them a green tinge.

VARNISHING.

216. The object of varnishing a picture is to protect it gainst the noxious agents usually present in the atmosphere, uch as smoke, dust, sulphurous vapours, etc., as well as from accident by scratching, chafing, etc.

217. The application of varnish should be an object of mature consideration, both as to the choice of the varnish, and the time at which it is applied.

218. The varnish that offers the greatest durability from its toughness and hardness would appear to recommend itself best, these qualities are found combined in an eminent degree in Copal and Amber; those who object to their colour may make use of Mastic.

219. Before the varnish is applied it should be placed before the fire, so as to drive off any moisture; the picture should also be thoroughly dry and clean, and the operation of Varnishing performed in a warm, dry room.

220. A varnish should never be applied to a picture until the paint has become thoroughly hard and solid; if it be applied before this hardening has taken place, the difference of contraction between the paint and the varnish causes the latter to crack.

221. An oil-varnish is much less liable to crack than a turpentine varnish; for in the first, there is little or no

evaporation or contraction, while in the latter, there is, on the contrary, much of both.

222. The process of Varnishing is so simple an affair that there can be no secrets in it, however much designing empirics may pretend to the contrary. An ignorant quack may mix certain ingredients of the nature of which he knows nothing, but the compound is more likely to be mischievous than salutary to the picture to which it is applied.

223. When the light of common sense is brought to bear on this subject, all the obscurity of presumptuous ignorance must disappear. Many a valuable picture is irretrievably ruined by a *secret* varnish.

224. A good varnish does not become discoloured by age, a nostrum may. If a varnish contains substances that blacken by contact of sulphurous vapours, it fails in the very object for which it is used, namely,—that of protecting the pictures painted with pigments which consist of salts of lead, against noxious vapours.

225. It has been suggested, that if an artist paints a picture which he intends to endure as long as such perishable things can last,—after his picture has become thoroughly hardened, (which may take twelve months,) let him cover it with some six or more coats of pale copal varnish, treating it just as the coach makers do their carriage bodies, polishing this varnish with pumice, etc., until it resembles a sheet of plate-glass. His picture will then be tolerably safe from every attack of the cleaners, short of actual destruction.

226. A picture so treated may be pronounced imperishable under ordinary circumstances; if the canvas decays, it can be re-lined; the paint is as durable as the varnish, and the copal

will resist all solvents, and only succumb to rasp, file, razor, or grit-sand.

227. A good varnish covers a picture like a sheet of plate-glass, through which it can be seen in all the purity of its hues, and by which it can be preserved to future ages in its pristine beauty.

228. As we have shewn, the quality of a varnish must depend upon the resin of which it is composed; the varnish is but this resin spread evenly, by the medium of a solvent, over the surface of the picture. If we examine the resin, and find it transparent, slightly coloured, hard, and tough, we may conclude the varnish will possess the same qualities.

229. A singularly perverse notion seems to prevail, that a varnish, when applied to a picture, must at some time or other be removed. No varnish should ever be applied to a picture upon which the shadow of suspicion can rest that it will ever be necessary to remove it. If the varnish is a good one, this necessity can never arise. A varnish may become dirty, but it can be cleaned without being removed, as the dirt is only on the surface, that is supposing it a suitable one, and properly applied. Under ordinary circumstances, only smoke and dust can attach themselves to a picture, these may be easily and safely removed by soap and water, and a soft sponge, unless the varnish is cracked, then only a damp cloth can with safety be applied.

230. Much of the mischief attendant upon improper varnishing arises from the practice of painting for Exhibitions. Before a picture is scarcely dry, it is varnished; and this varnish is generally applied with the expectation that it will some day require to be removed. If the varnish be the least

tacky, it gathers up a thick coat of dust, which, as the varnish hardens, dries in, and can only be removed by the removal of the varnish that retains it.

231. It has been proposed that a temporary varnish of gelatine or isinglass should be applied, which could be subsequently removed by a sponge and water without injury to the picture.

232. CHILLING. Many reasons are assigned for the *Chilling* of a varnish. We are inclined to attribute it to the presence of moisture, and if the precautions of warming the varnish and drying the picture are attended to, it will probably not occur.

PICTURE CLEANING.

233. In reading the processes usually recommended for Picture Cleaning, we are forcibly reminded of the horrors of the Inquisition and its instruments of torture. Such is the fearful array presented by rasps, files, razors, on the mechanical side, and naptha, ether, alcohol, oil of spike, turpentine, *liquor ammonia fortiss*, oil of tartar, soda, etc., on the chemical. These are all potent agents of destruction, and it would be better to let the dark veil on a good picture remain for ever than submit to the discipline required by the use of such agents, the injudicious or even incautious use of any one of which would destroy a work of art.

234. The evidence given before the Committee of the House of Commons clearly shows how little the nature of paint or varnish is really understood. The light of science would appear to have not yet dawned upon the region of art.

235. Now, as *Picture*-cleaning is usually *Varnish*-cleaning, or rather Varnish-removing, it would seem natural that those who take upon themselves the responsible and delicate task of picture cleaning should, at least, have made themselves acquainted with the nature and properties of the materials they operate upon. But, no ! their proceedings are enveloped in the mysteries of quackery, and a host of nostrums are recommended and applied without the slightest knowledge of the effects they are likely to produce, beyond this, that they *remove* the varnish somehow and most frequently the picture also.

236. If the reader has carefully perused the preceding pages, he will have acquired a rational idea of the nature both of paint and varnish;—that the paint consists mainly of an oil, which, by absorbing oxygen, has become converted into a kind of tough resin; he will also have learned that this resinous oil is insoluble in water and alcohol, is but slightly soluble in oil, and more readily soluble in turpentine and the alkalies. The Varnish he will have learned consists of resins soluble or insoluble in certain essential and fixed oils.

237. Now, suppose it is desired to clean an unvarnished picture. The dirt upon it consists most probably of dust and smoke. Sometimes, when pictures are treated as articles of furniture, they are found covered with beeswax.

If the dirt consists only of dust and smoke, the only solvent necessary is a sponge and soft water. If, however, the smoke and dirt are of long accumulation, a *little* curd soap will assist in its removal, but the free alkali generally present in soap is apt to attack the oil of which the paint is composed, and convert it into soap, so that it must be sparingly applied and quickly removed; and the picture must be afterwards washed with clean water and wiped dry with a piece of wash-leather, else when dry, it will be covered with a white film.

238. Sometimes the smoke, which generally contains resinous matter, will not yield to soap and water. In that case, we may apply, with a soft sponge, a mixture of spirits of wine and camphine, about seven-eighths of the first to one-eighth of the second. Camphine alone would quickly attack the paint; the spirits of wine has no action upon it, and therefore dilutes the camphine so much that it can be applied without much risk.

To an unvarnished picture no other application can be recommended or is even necessary. We will now consider the proper mode of treating a *varnished picture.*

239. We should commence by trying to remove the dirt by the same means recommended for cleaning an unvarnished picture, which are as applicable to the one as to the other. If the result is not such as desired, and it is decided that the varnish must be removed—an operation that appears to us as revolting as it would be to flay a living Venus—then, after it has been washed, rub one corner of the picture with a piece of folded linen rag dipped in the mixture of Camphine and Spirits of Wine. If it is a turpentine varnish, such as Mastic or Dammar, it will probably soon yield, but if it does not, the quantity of Camphine may be gradually increased. The removal of the varnish will be seen by the condition of the rag, which must be changed as soon as it becomes foul.

240. If no effect is produced by this application, we may conclude the picture is covered with a hard oil-varnish, such as Copal; in that case, instead of trying to remove it, which

can scarcely ever be done without injury to the picture, it will be better to polish it with fine tripoli powder and water, or oil, finishing with a piece of soft wash leather.

241. Knowing the difficult solubility of copal and amber resins, we can appreciate the difficulty attending every attempt at their removal from the surface of a picture by means of solvents. The *corrosive* agents recommended for that purpose, such as soda, liquor ammonia, oil of tartar, ether, naptha, and alcohol will have very little effect upon the hard resins, while, if they reach the oil-paint, they immediately attack and destroy it.

242. As for files, razors, and such mechanical agents, it is only necessary to consider the natural unevenness of the surface of the most carefully finished picture, to become aware of the utter impossibility of removing the varnish by such rude appliances, without at the same time removing the more prominent parts of the paint as well.

243. The same remarks apply to rough friction by the finger's end or palm of the hand; this treatment may be allowable when an old picture has been recently covered with a bad turpentine varnish, which admits of being removed by this means without injury to the picture.

244. In some pictures the varnish is coloured and employed as a glazing, or the varnish unites so completely with the glazing that the one cannot be removed without the other.

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